METHODS AND APPARATUS FOR FABRICATING, HANDLING AND TRANSPORTING ELONGATE BAGS OF MATERIAL

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates broadly to methods and apparatus for fabricating, handling and transporting elongate bags of material, such as loose-fill thermal insulation.

2. State of the Art

In recent years, the use of blowable (or pourable) loose-fill thermal insulation products has increased in popularity because it can be easily and quickly applied in both new construction as well as in existing structures. The loose-fill thermal insulation product may be made of glass-fiber material, such as the Insulsafe® brand commercially available from Certainteed Corporation of Valley Forge, PA. Alternatively, the loose-fill insulation product may be made of cellulose material.

The loose-fill thermal insulation product is typically packaged in elongate bags at the factory for distribution therefrom. For blown-in applications, the loose-fill insulation product is installed by adding the product to the hopper of a pneumatic blower which blows the insulation into the desired area under control of a human operator. For pour-in applications, the loose-fill insulation product is removed from its bag and poured into the desired area by hand.

Prior to transport from the factory, the bags of loose-fill thermal insulation product are arranged in rows stacked upon one another. In general, the finished stacks are handled by clamp trucks (for example, moving the stacks from the end of the production line to a warehouse or to transport trucks). The parallel stacking pattern is used normally on the bottom layer of bags in each stack so that the clamp truck can pick up the stack without dropping bags. In this configuration, the longitudinal dimensions of the bags are aligned in the same direction and the clamp truck clamps the stack such that the closing force of the clamps are parallel to the longitudinal axis of the stacked bags as shown in Fig. 1A.

If the clamp truck were to attempt to pick up a stack whose bottom layer was cross-stacked as shown in Fig. 1B, the majority of the clamping force would be transmitted perpendicular to the longitudinal axis of two of the cross-stacked bags as shown. In this configuration, once the stack is lifted, gravity pulls the bags downward. Because the two bags lack a friction force to keep from sliding past one another, they tend to roll out of the bottom of the clamps as shown in Fig. 1C, which causes the entire stack to fall over and result in undue delays in handling the bags.

Although the parallel-stacked configuration is suitable for handling by a clamp truck, it is not suitable when used for the bottom row of a stack that is to be picked up by a fork lift, which is used by most customers (e.g., retailers, contractors, distributors, installers) to handle the stacks. Therefore, before the stack is loaded onto a transport

truck, the bottom parallel-stacked row is typically manually arranged in a cross-stacked configuration. In this manner, the customer can readily unload the stack with a fork lift.

Such manual arrangement of the thermal insulation bags for transport to customers is labor intensive and thus costly to implement. Thus, there remains a need in the art to provide for improved methods and systems for the arrangement of loose-fill thermal insulation bags for transport to customers, wherein the arrangement is carried out in a manner that is less manually intensive and thus less costly than the prior art methods.

SUMMARY OF THE INVENTION

It is therefore an object of the invention to provide improved material handling methods and systems for the automatic (e.g., machine-based) arrangement of loose-fill thermal insulation bags in a manner suitable for transport to and by customers (such as retailers, contractors, distributors, installers).

It is another object of the invention to provide material handling apparatus that can be used to realize such methods.

In accord with these objects, which will be discussed in detail below, a material handling method (and corresponding system) packages material (such as loose-fill thermal insulation product) into elongate bags, and automatically arranges the elongate bags into groups, wherein at least one group has a cross-stacked configuration. The bag

groups are automatically lifted and transported to form a multi-row stack of elongate bags whose bottom row is realized by a cross-stacked group. The multi-row stack is transported to a customer. The elongate bags preferably each have dimensions of about 38" by 21" by 8.5" and carry about 27 lbs. of product.

It will be appreciated that such material handling methodology (and systems based thereon) avoids manual arrangement of the elongate bags of thermal insulation product and thus provides valuable cost savings to the manufacturer.

According to one embodiment of the invention, a stacker machine automatically lifts and transports groups of elongate bags to form the multi-row stack. The stacker machine has a moveable stacker head with fingers that grip a given group of elongate bags and at least one support structure that is operably disposed between the bags disposed side-by-side in the cross-stacked configuration to provide a friction fit therebetween.

According to another embodiment of the invention, a modified clamp truck is used to lift and transport the bag groups. The clamp truck has two clamp members that translate relative to one another with one clamp member having a central support bar integral thereto and laterally disposed between the two clamp members. The central support bar fits into a slot in a conveyor belt system to facilitate positioning the two clamp members around a cross-stacked bag group supported by the conveyor belt system.

Additional objects and advantages of the invention will become apparent to those skilled in the art upon reference to the detailed description taken in conjunction with the provided figures.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1A is a schematic illustration of the clamp force applied to a parallel-stacked row of elongate bags of loose-fill thermal insulation product.

Fig. 1B is a schematic illustration of the clamp force applied to a cross-stacked row of elongate bags of loose-fill thermal insulation product.

Fig. 1C is a schematic illustration of the bag roll that results from the application of the clamp force to the cross-stacked row shown in Fig. 1B.

Fig. 2 is a flow chart illustrating the methodology of fabricating, handling, and transporting elongate bags of loose-fill thermal insulation product in accordance with the present invention.

Fig. 3 is a partial perspective view of a stacker machine that forms a multi-row stack of elongate bags of loose-fill thermal insulation product in accordance with the present invention.

Fig. 4 is a cut away perspective view of a conveyor assembly that supports a multi-row stack of elongate bags of loose-fill thermal insulation product in accordance with the present invention.

Fig. 5A is a perspective view of a clamp mechanism that is used as part of clamp truck for loading and lifting the multi-row stack of Fig. 4 in accordance with the present invention.

Fig. 5B is a side view of the clamp mechanism of Fig. 5A.

Fig. 6 is a cut away perspective view of a conveyor belt system that includes a slot that accepts the central support flange of the clamp mechanism of Figs. 5A and 5B to thereby facilitate loading and lifting of the multi-row stacks of loose-fill thermal insulation product from the conveyor belt system in accordance with the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Turning now to Fig. 2, there is shown a flow chart illustrating the methodology for fabricating, handling and transporting elongate bags of loose-fill thermal insulation in accordance with the present invention. The methodology begins in block B10 by fabricating blowable (or pourable) loose-fill thermal insulation product. The details of an exemplary method for fabricating the blowable (or pourable) loose-fill thermal insulation

product is described in detail in U.S. Patent 5,683,810 to Babbitt et al., herein incorporated by reference in its entirety. In this system, glass fibers are produced by a fiberizer assembly from molten glass supplied by a furnace. The glass fibers are collected to form a fibrous blanket that is cut into nodules by an in-line chopping device. A dust-suppressant/anti-static agent is applied to the nodules.

In block B20, the loose-fill thermal insulation product is collected and packaged into elongate bags. Machinery for packaging the loose-fill thermal insulation product is well known in the art. For example, see U.S. Patents 4,716,712 and 4,640,082, herein incorporated by reference in their entirety. The elongate bags generally have an elongate shape whose maximum length is substantially greater than its maximum width. The elongate bags may have dimensions of about 38" by 21" by 8.5" and carry about 27 lbs of product. Such dimensions and weight enable the bags to be carried into attics and crawlspaces. It should be appreciated that the dimensions and weight of the bag may vary as desired. The bags preferably comprise a suitable polymer (such as polyethylene) which is flexible and water resistant yet provides adequate structural support to hold the product during transport.

In block B30, the bags are automatically arranged into groups each having either a parallel-stacked configuration or a cross-stacked configuration. In the parallel-stacked configuration, the longitudinal dimensions of the bags are aligned along the same direction as shown in Fig. 1A. In the cross-stacked configuration, a first set of bags (201A, 201B) are disposed side-by-side along their lengths, and one or more additional

bags (203) are disposed orthogonal to and adjacent these first set of bags as shown in Figs. 3 and 4. In this configuration, the lengths of the first set of bags (201A, 201B) are substantially aligned along a first direction (e.g., y-direction) and the length(s) of the one or more additional bags (203) are aligned along a second direction (e.g., x-direction) that is orthogonal to the first direction as shown. Preferably, the desired bag pattern (either parallel-stacked or cross-stacked) is arranged by a series of rollers and mechanical diverters. The selection of the desired bag pattern is preferably controllable via software (or other programming mechanism) as is well known in the material handling arts.

In block B40, a stacker machine automatically lifts the bag groups arranged in block B30 to form a multi-row stack of bags. Preferably, the multi-row stack contains at least thirteen layers of three-bag rows for a total of 39 elongate bags per stack. The bottom row of the multi-row stack has a cross-stacked pattern. The rows above the bottom row may have a parallel stacked pattern or a cross-stacked pattern. An exemplary stacker machine is shown in Fig. 3. Each bag group is arranged in a staging area 301 in the desired pattern (either cross-stacked or parallel-stacked). Once the bags are arranged in the desired pattern, a stacking head 303 lowers and grips the bag group with its fingers 305A, 305B, 305C, 305D in a manner similar to that shown in Fig. 1A for the parallel-stacked configuration and shown in Fig. 1B for the cross-stacked configuration. The problem of roll-out with respect to the cross-stacked pattern (discussed above with respect to Fig. 1B and 1C) is remedied by the presence of small chains 307A, 307B that are located to fit between the two lengthwise bags of the cross-stacked pattern when the stacker head 303 is lowered down. The chains 307A, 307B are sandwiched between the

two lengthwise bags when the fingers 305A, 305B, 305C, 305D clamp shut to provide a friction fit therebetween that prevents the two lengthwise bags from slipping past one another. The chains may be readily substituted with wire strands, rope strands or other support structures that fit between the lengthwise bags and prevent such bags from slipping past one another. After gripping the bag group, the stacking machine automatically lifts the bag group and moves it onto the top of the multi-row stack that it is building. Typically, the multi-row stack is built at a location adjacent the staging area. This process is repeated for each row of the multi-row stack. Preferably, the operations of the stacker machine are automated via software-based control systems (or other programming mechanisms) as are well known in the material handling arts.

After the formation of the multi-row stack is complete, the multi-row stack is lifted for transport (for example, to a warehouse or to a transport truck) in block B50. Advantageously, the cross-stack bag arrangement of the bottom row of the multi-row stack is suitable for unloading with a fork lift. Preferably, the stack is transported by a conveyor system to an area where it is picked up by a clamp truck. In Fig. 4, the end of the conveyor system is shown with a multi-row stack disposed thereon. The clamp truck has two pinching clamp members 501, 503 as shown in Fig. 5A. An exemplary clamp truck is described in detail in U.S. Patent 3,971,584 to Duncan, herein incorporated by reference in its entirety. The two clamp members 501, 503 translate relative to one another, preferably under hydraulic control, to grasp the elongate bag group positioned therebetween. One of clamp members (for example, the clamp member 501) has a central support bar 505 integral thereto as shown in Figs. 5A and 5B. The central support

bar 505 is preferably a flat bar four inches to six inches wide that is welded to a bottom edge of one of the clamp members such that it is fixed to a lateral position midway between the two clamp members. The central support bar 505 extends below the major clamping surfaces of the clamping members and fits into a slot 603 in the conveyor belt system 601 as shown in Fig. 6 to facilitate positioning the clamps members 501, 503 around a bag group supported by the conveyor belt system for loading and lifting of the bag group therefrom. Preferably, the slot 603 is formed by a void between two traction belt drives 605B and 605C as shown. The traction belt drives 605A, 605B, 605C, 605D extend the conveyor belt system 601. In this configuration, the central support bar 505 rests under the central region of the bag(s) of the cross-stacked arrangement that are aligned orthogonal thereto to provide support to these bag(s) when the cross-stacked bag group is grasped and lifted by the pinching and lifting motion of the clamp members 501, 503 of the clamp truck.

There have been described and illustrated herein several embodiments of a method and corresponding apparatus for handling elongate bags of loose-fill thermal insulation product. While particular embodiments of the invention have been described, it is not intended that the invention be limited thereto, as it is intended that the invention be as broad in scope as the art will allow and that the specification be read likewise. Thus, while particular material arrangements and configurations have been disclosed, it will be understood that other configurations can be used. Furthermore, while particular methodologies and corresponding apparatus have been disclosed for loose-fill thermal insulation product, it will be appreciated that such methods and apparatus can be readily

applied to other products packaged in elongate bags. Moreover, while particular machine configurations have been disclosed, it will be appreciated that other machine configurations could be used as well. For example, and not by way of limitation, the central support bar may be affixed to one of the clamping members by non-rigid means to enable slidable movement of the central support bar relative to the one clamping member. This feature may be advantageous because it allows the corresponding slot in the conveyor system to be narrower (it is no longer constrained by the amount of travel required for grasping a bag group) and thus provides for improved support of the bag group. It will therefore be appreciated by those skilled in the art that yet other modifications could be made to the provided invention without deviating from its spirit and scope as claimed.